The Relationship Between Serum Uric Acid Level and Aortic Compliance in Patients with H-Type Hypertension (Postprint)

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Abstract

Objective: To investigate the relationship between serum uric acid level and aortic compliance in patients with H-type hypertension (HHT). Methods: A total of 102 HHT patients were enrolled as the observation group and 106 non-HHT hypertensive patients as the control group. Differences in medical history, blood lipids, renal function, hepatic function, and other indicators were compared between the two groups. Brachial artery blood pressure was measured, and left ventricular function and aortic compliance were assessed via echocardiography. The correlations among various indicators were analyzed. Results: The observation group showed higher rates of high-frequency seafood consumption (>1000 g/d, 20 vs 11), family history of hypertension (21 vs 10), uric acid level (437.28±129.32 mol/L vs 339.58±117.89 mol/L), and homocysteine level (19.65±4.82 mol/L vs 10.38±3.19 mol/L) compared with the control group (P<0.05). The left ventricular end-systolic and end-diastolic diameters and ejection fraction in the observation group were all lower than those in the control group (P<0.05). Systolic blood pressure and aortic stiffness index in the observation group were higher than those in the control group, whereas diastolic blood pressure, aortic tension, and distensibility index were lower (P<0.05). Correlation analysis revealed that seafood intake and uric acid were negatively correlated with aortic tension and distensibility index, while the former two were positively correlated with stiffness index (P<0.05). Conclusion: Patients with H-type hypertension have higher uric acid levels than non-H-type hypertensive patients, and both uric acid and seafood intake are associated with decreased aortic compliance.

Full Text

Correlation Between Serum Uric Acid Levels and Aortic Compliance in Patients with H-Type Hypertension

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Abstract

Objective: To investigate the relationship between serum uric acid levels and aortic compliance in patients with H-type hypertension (HHT).
Methods: A total of 102 HHT patients were enrolled as the observation group, and 106 non-HHT hypertensive patients served as the control group. Medical history, serum lipids, renal function, and liver function indices were compared between groups. Brachial artery blood pressure was measured, and left ventricular function and aortic compliance were assessed via echocardiography. Correlations among various indicators were analyzed.
Results: The observation group exhibited significantly higher rates of frequent seafood consumption (>1000 g/d, 20 vs. 11 cases), family history of hypertension (21 vs. 10 cases), uric acid levels (437.28±129.32 mol/L vs. 339.58±117.89 mol/L), and homocysteine levels (19.65±4.82 mol/L vs. 10.38±3.19 mol/L) compared to the control group ($P<0.05$). Left ventricular end-systolic diameter, end-diastolic diameter, and ejection fraction were all lower in the observation group ($P<0.05$). Systolic blood pressure and aortic stiffness index were higher in the observation group, while diastolic blood pressure, aortic tension, and distensibility index were lower ($P<0.05$). Correlation analysis revealed that both seafood intake and uric acid levels were negatively correlated with aortic tension and distensibility index, and positively correlated with stiffness index ($P<0.05$).
Conclusion: HHT patients have higher uric acid levels than non-HHT hypertensive patients, and both uric acid levels and seafood intake are associated with decreased aortic compliance.

Keywords: H-type hypertension; uric acid; high-purine diet; vascular endothelial function; aortic compliance

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H-type hypertension (HHT) is a special type of hypertension complicated by hyperhomocysteinemia [1]. Since hyperhomocysteinemia is an independent risk factor for hypertension, HHT carries a higher incidence of cardiovascular events than general hypertension [2]. However, the impact of seafood consumption habits on vascular function in HHT remains underexplored. Building upon our team' s previous research on vascular endothelial injury [3] and pharmacological interventions [4] in HHT patients, this study investigated the relationship between dietary factors—particularly high-purine diets—and vascular complications in HHT. We found that hyperuricemia is associated with decreased aortic

compliance, providing evidence for dietary intervention in these patients.

1.1 General Data

Hypertensive patients admitted to our hospital' s cardiovascular department between January 2013 and December 2016 were enrolled. Inclusion criteria were: systolic blood pressure (SBP) >140 mmHg or diastolic blood pressure (DBP) >90 mmHg at rest, and serum homocysteine >15 mol/L. Secondary hypertension [5] was excluded. A total of 102 HHT patients were selected (63 males, 39 females; mean age 63.18±18.47 years). Concurrently, 106 hypertensive patients without hyperhomocysteinemia were enrolled as the control group (68 males, 38 females; mean age 61.09±17.62 years). No statistically significant differences in gender composition or age were observed between groups (P>0.05), ensuring comparability.

2.1 Baseline Data Comparison

We compared between-group differences in smoking history, alcohol consumption, diabetes, and family history of coronary artery disease. Additionally, we analyzed differences in serum lipids, blood glucose, glycated hemoglobin, renal function, bilirubin, and serum homocysteine levels [6]. The criterion for frequent seafood consumption was defined as: at least two meals per day or intake >1000 g/d [7].

1.3 Measurement of Vascular Endothelial Function and Aortic Compliance

Brachial artery SBP and DBP were recorded as indirect indicators of vascular endothelial function. Transthoracic echocardiography was performed using a Philips IE33 color echocardiograph with simultaneous lead II ECG recording. M-mode ultrasound was first used to measure left heart parameters (left ventricular systolic time, left ventricular end-systolic and end-diastolic diameters, left ventricular mass index, left ventricular ejection fraction). Subsequently, ascending aortic systolic and diastolic diameters (Aos and Aod) were measured at the same angle to calculate aortic tension, distensibility index, and stiffness index (the latter three serving as quantitative indicators of aortic compliance) [8].

1.4 Statistical Analysis

Data analysis was performed using SPSS 17.0 software. Measurement data were expressed as mean±standard deviation, and comparisons between groups were conducted using t-tests. Count data were compared using chi-square tests. Spearman correlation analysis was used for non-measurement data, while Pearson correlation analysis was employed for measurement data. P<0.05 was considered statistically significant.

2.1 Baseline Data Comparison

No statistically significant differences were observed between groups in smoking history, alcohol consumption, diabetes, or family history of coronary artery disease (P>0.05). Similarly, no significant differences were found in serum lipids, blood glucose, glycated hemoglobin, renal function, or bilirubin levels (P>0.05). However, the observation group showed higher rates of frequent seafood consumption and family history of hypertension compared to the control group (P=0.036, 0.032), along with elevated uric acid and homocysteine (HCY) levels (P=0.031, 0.026, Table 1).

2.2 Echocardiographic Parameters

No statistically significant differences were observed in left ventricular systolic time or ejection fraction between groups. However, left ventricular end-systolic diameter, end-diastolic diameter, and ejection fraction were all lower in the observation group (P=0.039, 0.046, 0.043, Table 2).

2.3 Blood Pressure and Aortic Compliance Parameters

SBP was higher in the observation group than in the control group (P=0.033), while DBP was lower (P=0.042). Aortic tension and distensibility index were also lower in the observation group (P=0.039, 0.044), but aortic stiffness index was higher (P=0.031, Table 3).

2.4 Correlation Analysis

Correlation analysis between the assigned "frequent seafood consumption" variable, uric acid levels, and aortic compliance revealed that both seafood intake and uric acid were negatively correlated with aortic tension and distensibility index, and positively correlated with stiffness index (P<0.05, Table 4).

3 Discussion

This study identified an association between dietary factors and decreased aortic compliance, a phenomenon rarely reported in current literature. Nearly one-fifth (20/102) of our patients had a history of frequent seafood consumption, including approximately 30% of non-Guangdong natives, primarily consuming purine-rich seafood such as shrimp and crab, which significantly increases the risk of hyperuricemia [9]. A European study analyzing uric acid levels and arterial function in 1,225 newly diagnosed, untreated hypertensive patients found that these patients had significantly slower carotid-femoral pulse wave velocity, lower aortic stiffness, and augmentation index compared to controls. Carotid-femoral pulse wave velocity was significantly positively correlated with serum uric acid, while augmentation index was significantly negatively correlated [10]. This study suggests that serum uric acid level is an independent risk factor for aortic sclerosis in untreated hypertensive patients [11]. Our finding that

HHT patients had significantly higher uric acid levels than non-HHT patients is consistent with Chen et al. [12].

Vascular endothelial dysfunction is the pathophysiological basis of arteriosclerosis, with numerous assessment methods available, including nitric oxide, endothelin, and platelet aggregation inhibitors. However, these factors often lack specificity, limiting their application in cardiovascular medicine [13]. Recent evidence demonstrates that high-resolution ultrasound can sensitively and non-invasively evaluate arterial endothelial function by measuring flow-mediated brachial artery dilation [12]. Using this method, we found that observation group patients had higher SBP but lower DBP than controls, with increased pulse pressure, suggesting decreased peripheral vascular endothelial function. Since flow-mediated dilation only partially reflects brachial artery endothelial function and cannot represent aortic endothelial function, we used echocardiography to assess compliance. The observation group showed smaller left ventricular end-systolic diameter, end-diastolic diameter, and ejection fraction, indicating left ventricular remodeling. Further analysis revealed lower aortic tension and distensibility index but significantly higher aortic stiffness index, confirming markedly decreased aortic compliance in HHT patients, consistent with Zhang et al. [14]. The primary causes of decreased compliance appear to be related to left ventricular remodeling and homocysteine-induced impairment of myocardial autophagy.

Using vascular endothelial function as a link, correlation analysis effectively bridged dietary factors and aortic compliance: frequent seafood consumption and serum uric acid levels were significantly negatively correlated with aortic tension and distensibility index, and positively correlated with stiffness index [15], suggesting that higher purine intake leads to elevated uric acid, lower aortic tension and distensibility, and greater aortic stiffness [16].

Our study demonstrates a significant correlation between uric acid and decreased aortic compliance in HHT patients, suggesting that these patients should limit high-purine food intake [17] and increase folic acid and B-vitamin consumption to protect vascular endothelial function [18]. These findings also provide a basis for personalized ACE inhibitor intervention [19], particularly in elderly hypertensive patients with hyperuricemia, where uric acid control is especially meaningful [20]. These results offer valuable clinical guidance. Limitations include insufficient sample size and short observation period, which will be addressed in future studies.

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Note: Figure translations are in progress. See original paper for figures.